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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/045,354	11/07/2001	Angela Hui	AF01159	1692

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EXAMINER

NGUYEN, KHIEM D

ART UNIT PAPER NUMBER

2823

DATE MAILED: 04/02/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/045,354

Applicant(s)

HUI ET AL.

Examiner

Khiem D Nguyen

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 16 January 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-26 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-26 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 07 November 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ 6) ☐ Other: _____

DETAILED ACTION

The non-final rejection as set forth in paper No. (4) is withdrawn in response to applicants' amendments.

A new rejection is made as set forth in this Office Action.

Claims (1-26) are pending in the application.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claim 24 recites the limitation "the polysilicon layer" in lines 3-4. There is insufficient antecedent basis for this limitation in the claim.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

1. Claims 1-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hemmenway et al. (U.S. Patent 5,270,265) in view of Bothra (U.S. Patent 6,159,844).

Hemmenway teaches a method of stripping a hard mask 11 from a substrate 42 comprising an insulated material 21 exposed within gaps patterned 43 through the hard mask wherein the insulating material comprises silicon oxide and the hard mask material comprises silicon nitride and wherein the hard mask is employed to etch a layer of the

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substrate comprising silicon, a silicon wafer and a polysilicon layer, comprising (See col. 3, line 15 to col. 4, line 26 and FIGS. 4-8):

coating the substrate with a sacrificial material 51 (col. 3, lines 53-60) comprises resists that fills the gaps; and

etching to strip the sacrificial material and the hard mask (col. 3, line 61 to col. 4, line 26) wherein the sacrificial material is strip using plasma etching (col. 4, lines 14-26) and wherein plasma etching completely removes the sacrificial material from the gaps (FIG. 8).

Hemmenway discloses plasma etching the sacrificial material but fails to explicitly disclose plasma etching the hard mark wherein the plasma etching is carried out with gases comprising a fluorinated hydrocarbon and oxygen as recited in present claims 1, 7 and 19.

Bothra discloses (col. 7, lines 29-39 and TABLE B) plasma etching to strip the silicon hard mask (silicon nitride layer) wherein the plasma etching is carried out with gases comprising a fluorinated hydrocarbon and oxygen (CHF_3/O_2). Brothra also discloses (col. 6, lines 23-24) wherein the sacrificial material is spin-coated onto the substrate. It would have been obvious to one of ordinary skill in the art of making semiconductor devices to combine the teaching of Hemmenway and Bothra to enable the plasma etching process of Hemmenway to be performed and furthermore to avoid photoresist trapping (col. 4, lines 47-48).

2. Claims 21-26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hemmenway et al. (U.S. Patent 5,270,265) in view of Bothra (U.S. Patent 6,159,844) and Shimizu (U.S. Pub 2002/0117706).

Hemmenway teaches a method of removing a hard mask 11 comprising (See col. 3, line 15 to col. 4, line 26 and FIGS. 4-8):

forming an oxide region 21 over a semiconductor substrate 42 (col. 3, lines 19-20 and FIG. 4);

forming a silicon layer 15 over the semiconductor substrate, wherein the silicon layer covers the oxide region (FIG. 4);

forming and patterning a hard mask layer 11 (col. 3, lines 21-31) over the silicon layer (FIG. 4);

etching a gap 43 in the silicon layer to expose a portion of the oxide region using the patterned hard mask as an etch mask (FIG. 4);

forming a sacrificial layer having a relatively planar top surface comprises a photoresist 51 over the semiconductor substrate, thereby covering the hard mask layer and filling gap (FIG. 4); and

removing the sacrificial layer and the hard mask layer (col. 3, line 61 to col. 4, line 26 and FIGS. 7-8) wherein the sacrificial material is strip using dry etching (col. 4, lines 14-26) and wherein an etch rate of the sacrificial layer and an etch rate of the hard mask layer are selected to “substantially” completely remove the portion of the sacrificial layer covering the hard mask and the hard mask layer (FIG. 8).

Hemmenway discloses dry etching the sacrificial material but fails to explicitly disclose dry etching the hard mask layer wherein the sacrificial layer is spinning coating over the semiconductor substrate as recited in present claims 21 and 23. Brothra discloses dry etching to strip the silicon hard mask (silicon nitride layer) (col. 7, lines 29-39 and TABLE B) wherein the sacrificial material is spin-coated onto the substrate (col. 6, lines 23-24). It would have been obvious to one of ordinary skill in the art of making semiconductor devices to combine the teaching of Hemmenway and Bothra to enable the dry etching process of Hemmenway to be performed and furthermore to avoid photoresist trapping (col. 4, lines 47-48).

Neither Hemmenway nor Bothra discloses removing the sacrificial layer and the hard mask layer with a single etch process as recited present claim 24.

Shimizu discloses removing the sacrificial layer and the hard mask layer using a single etch process (page 5, paragraph [0081]). It would have been obvious to one of ordinary skill in the art of making semiconductor devices to combine the teaching of Hemmenway, Bothra and Shimizu to enable the single etch process of Hemmenway to be performed.

Hemmenway fails to explicitly disclose the etch rate of the sacrificial, hard mask, and silicon layers as recited in present claims 21 and 24.

However, there is no evidence indicating that the etch rate of the sacrificial, hard mask, and silicon layers are critical and it has been held that it is not inventive to discover the optimum or workable rate of a result-effective variable within given prior art conditions by routine experimentation. See MPEP 2144.05.

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Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Khiem D Nguyen whose telephone number is (703) 306-0210. The examiner can normally be reached on Monday-Friday (8:00 AM - 5:00 PM).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Chaudhuri Olik can be reached on (703) 306-2794. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 746-9179 for regular communications and (703) 746-9179 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

K.N.
March 26, 2003



Olik Chaudhuri
Supervisory Patent Examiner
Technology Center 2800